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Four Unrecorded Species of Genus *Alloptes* (Acari: Sarcoptiformes: Alloptidae) from Charadriiform Birds in South Korea

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ABSTRACT

Four feather mites, *Alloptes* (*Apodalloptes*) *orthogramme* Gaud and Mouchet, 1957, *Alloptes* (*Conuralloptes*) *limosae* Dubinin, 1951, *Alloptes* (*C.*) *procerus* Gaud, 1972 and *Alloptes* (*Sternalloptes*) *fauri* Gaud, 1957 are reported for the first time in South Korea. These specimens were collected from four charadriiform bird species: *Actitis hypoleucos*, *Larus crassirostris*, *Limosa limosa*, and *Numenius phaeopus*. The family Alloptidae Gaud, 1957 and a genus *Alloptes* Canestrini, 1879 are newly added to the invertebrate fauna of South Korea as well. Here, we provide the morphological description and illustrations based on the present specimens. Additionally, partial sequences of the mitochondrial cytochrome *c* oxidase subunit I (*COI*) were newly-generated for using as DNA barcodes.

Keywords: *Alloptes*, Alloptidae, charadriiform bird, *COI*, feather mite, South Korea

INTRODUCTION

The genus *Alloptes* Canestrini, 1879 is one of about 23 genera that belong to the family Alloptidae Gaud, 1957 and contains about 46 species (Gaud and Atyeo, 1996; Mironov and Palma, 2006). This genus has been found on flight feathers and wing-coverts of birds from order Charadriiformes (Mironov and Palma, 2006). The genus *Alloptes* has the following diagnostic characteristics: (1) vertical seta is absent; (2) setae *kT* of tibiae III and setae *d* of tarsi II, III are absent; (3) in males, opisthosomal lobes are fused by medial margins into a single lobe; and (4) in females, lateral crest of tarsi III, IV are absent (Vasyukova and Mironov, 1991; Gaud and Atyeo, 1996; Mironov, 1996, 1998).

The genus *Alloptes* is divided into four subgenera: *Alloptes* s. str. Gaud, 1972, *Apodalloptes* Gaud, 1972, *Conuralloptes* Gaud, 1972, *Sternalloptes* Kivganov and Mironov, 1992 (Gaud, 1972; Kivganov and Mironov, 1992). These four subgenera are classified based on the setae structure of the anterior legs and opisthosomal chaetotaxy (Gaud, 1972; Kivganov and Mironov, 1992; Mironov, 1998; Mironov and Palma, 2006).

In the present work, we found four unrecorded species [*A.* (*Apodalloptes*) *orthogramme*, *A.* (*Conuralloptes*) *limosae*, *A.* (*C.*) *procerus* and *A.* (*Sternalloptes*) *fauri*] of feather mite during investigations of undiscovered invertebrate species in Korea. Here, we provide morphological description and illustrations of these feather mites with host information, and partial sequences of the mitochondrial cytochrome *c* oxidase subunit I (*COI*) as DNA barcodes.

MATERIALS AND METHODS

Feather mite specimens were obtained from the flight feathers and wing-coverts of the following four charadriiform bird species, i.e., black-tailed godwit *Limosa limosa*, black-tailed gull *Larus crassirostris*, common sandpiper *Actitis hypoleucos*, and whimbrel *Numenius phaeopus*. The carcasses of birds were donated or obtained by present authors from the Chungnam Wild Animal Rescue Center (three waders) or found on dead (the black-tailed gull). The collected mites were preserved directly in 95% ethyl alcohol. The mite specimens were cleared in 10% lactic acid for 24 hours and then mounted on microscope slides using PVA (PVA stock solution 56%, lactic acid 22%, and phenol 22%) as the mounting medium (Downs, 1943). The specimens were photographed using a microscopic digital camera (Lei-

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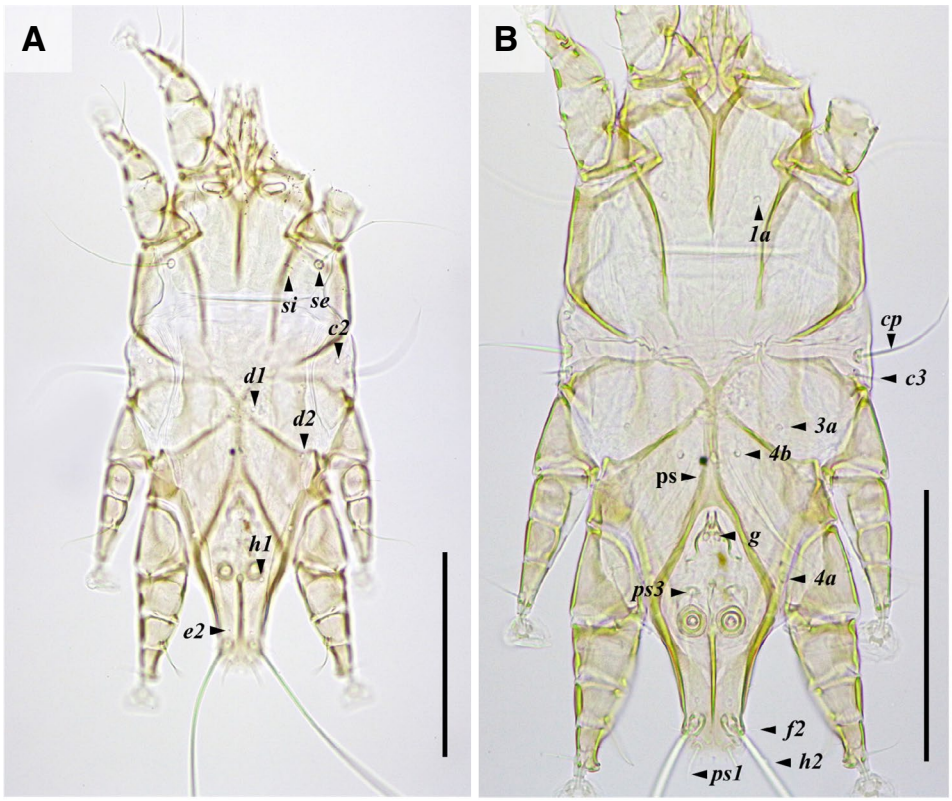

Fig. 1. *Alloptes* (*Apodalloptes*) *orthogramme*, male. A, Dorsal idiosoma; B, Venteral idiosoma. ps, pregenital sclerites. Scale bars: A, B = 0.1 mm.

ca, Wetzlar, Germany). Terms and measurements followed Gaud and Atyeo (1996), and Norton (1998). All examined specimens were deposited in the National Institute of Biological Resources (NIBR) and Inha University, Incheon, Korea.

DNA sequencing

DNA was extracted from individual mites using a LaboPass Tissue Genomic DNA Isolation Kit Mini (Cosmogenetech Inc., Seoul, Korea) according to the manufacturer's instructions. PCR amplification, purification, and sequencing were performed as described by Han et al. (2016).

SYSTEMATIC ACCOUNTS

Order Sarcoptiformes Canestrini, 1891

[1]*Family Alloptidae Gaud, 1957
[2]*Genus *Alloptes* Canestrini, 1879
[3]*Subgenus *Apodalloptes* Gaud, 1972

[4]***Alloptes* (*Apodalloptes*) *orthogramme* Gaud and Mouchet, 1957 (Figs. 1, 2)**

Alloptes orthogramme: Gaud and Mouchet, 1957: 496, fig. 1B; Zumpt, 1961: 241.
Alloptes (*Apodalloptes*) *orthogramme*: Gaud, 1972: 60; Vasyukova and Mironov, 1991: 84, fig. 60.

Material examined. 1♂, 1♀, Korea: Chungcheongnam-do, Cheongyang-gun, Jeongsan-myeon (36°22′34″N, 126°56′38″E), 12 Sep 2014, collected under a stereomicroscope from flight feathers on the wings of common sandpiper *A. hypoleucos* by Han Y.-D.

Description. Male (Fig. 1): Idiosoma size 265 × 110 μm (length × width). Prodorsal shield (Fig. 1A): Posterior margin straight, surface without ornamentation, length 63 μm along midline, width of posterior part 64 μm. Hysteronotal shield (Fig. 1A): Anterior margin straight, surface without ornamentation, length 178 μm from anterior margin to bases of setae *ps1*, width 70 μm at anterior part. Length 6 μm between prodorsal and hysteronotal shields. Setae *d2* situated on hysteronotal shield, bases of this setae without incisions.

Korean name: [1]*딴깃털진드기과(신칭), [2]*딴깃털진드기속(신칭), [3]*짧은다리딴깃털진드기아속(신칭), [4]*깝작도요짧은다리딴깃털진드기(신칭)

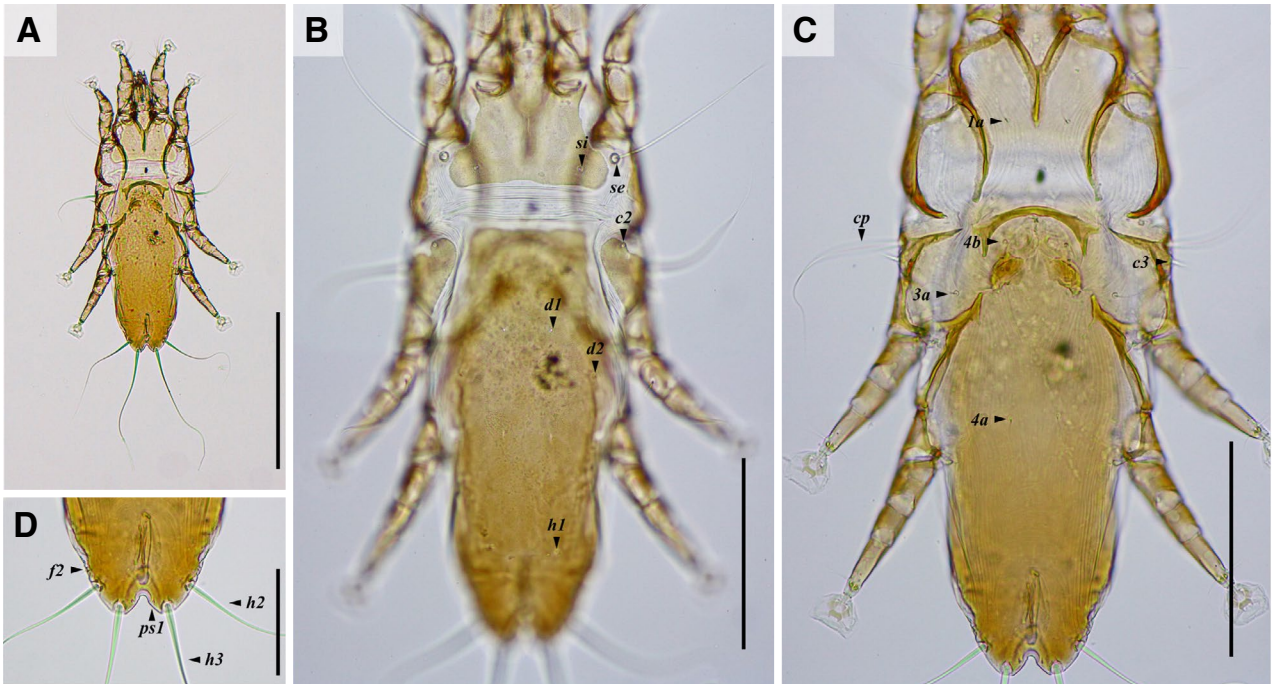

Fig. 2. *Alloptes* (*Apodalloptes*) *orthogramme*, female. A, Dorsal veiw; B, Dorsal idiosoma; C, Ventral idiosoma; D, Opisthosomal lobes. Scale bars: A = 0.2 mm; B, C = 0.1 mm; D = 0.05 mm.

Setae *h2* cylindrical, without extensions in the basal half. Distance between dorsal setae: *se*:*se* 75 μm, *c2*:*d2* 47 μm, *d2*:*ps1* 105 μm. Subhumeral setae *c3* lanceolate. Opisthosoma gradually narrowed to posterior end. Terminal lamella with tree pairs of festoons, teeth-shaped. Sternum (Fig. 1B): Epimerites I fused into a Y-shape. Pregenital sclerite (ps) fused in to a Y-shape and not connected to inner ends of epimerites IIIa. Coxal setae *3a* located anterior to setae *4b*. Genital arch 19 × 21 μm (length × width). Setae *4a* situated posterior to setae *g*. Small sclerites present at posterior margins of genital arch. Adanal shields inverted L-shaped, without protrusion at anterior-lateral margins. Setae *4a* surrounded by irregular sclerite. Length of genital-anal field 89 μm. Distance between ventral setae: *4b*:*3a* 8 μm, *4b*:*g* 31 μm, *4b*:*4a* 47 μm, *g*:*ps3* 20 μm, *ps3*:*ps1* 50 μm, *4a*:*4a* 52 μm. Setae *mG* of legs I and II short, spine-like with acute apex. Leg IV short and barely exceeding the end of opisthosomal lobe, 90 μm in length.

Female (Fig. 2): Idiosoma 320 × 125 μm (length × width) (Fig. 2A). Prodorsal shield (Fig. 2B): Mostly shaped as in male, length 73 μm along midline, width 85 μm. Hysteronotal shield (Fig. 2B): Anterior margin straight, length 220 μm from anterior end to bases of setae *h3*, width 60 μm at anterior part. Distance 24 μm between prodorsal and hysteronotal shields. Setae *h1* located anterior to setae *e2*. Opisthosomal lobes shorted, terminal cleft as inverted U-shaped. Distance between dorsal setae: *c2*:*d2* 68 μm, *d2*:*e2* 100 μm, *e2*:*h2* 30 μm, *h2*:*h3* 10 μm, *h2*:*h2* 45 μm, *h3*:*h3* 23 μm. Supranal concavity oval, divided from terminal cleft. Sternum (Fig. 2C, D): Epimerites I fused. Epigynum bow-shaped, 24 × 48 μm (length × width). Leg I and II as in the male. Ambulacral disc IV slightly beyond the level of setae *f2*.

Remarks. *Alloptes* (*A.*) *orthogramme* was originally described by Gaud and Mouchet (1957) based on specimens collected from *A. hypoleucos* in Cameroun. Thereafter, the ventral hysterosoma of this species was redescribed by Vasyukova and Mironov (1991) from *A. hypoleucos* in the Sakha Republic (= Yakutia Republic) of Russia.

Alloptes (*A.*) *orthogramme* is very similar to *A.* (*A.*) *curtipes* Trouessart, 1885 regarding the external traits. However, *A.* (*A.*) *orthogramme* can be clearly distinguished from *A.* (*A.*) *curtipes* by the following characteristics in males: (1) total body length is less than 350 μm; (2) setae *4a* are situated posterior to setae *g*; and (3) setae *h2* are cylindrical-shaped without extensions in the middle part (Gaud, 1972; Vasyukova and Mironov 1991). The morphology of the Korean specimen was consistent with the description and illustrations provided by Gaud and Mouchet (1957), and Vasyukova and Mironov (1991).

Host. This species was found on a flight feather in the wing of common sandpiper, *A. hypoleucos*.

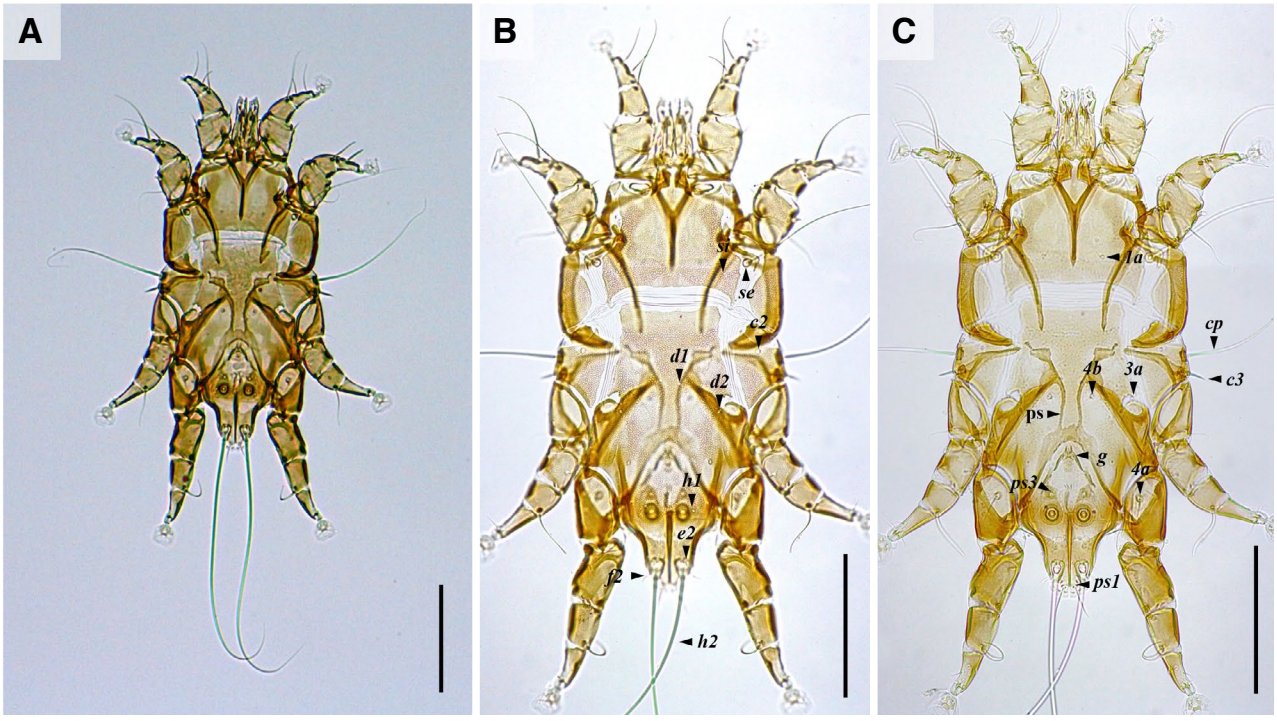

Fig. 3. *Alloptes* (*Conuralloptes*) *limosae*, male. A, Dorsal veiw; B, Dorsal idiosoma; C, Ventral idiosoma. ps, pregenital sclerites. Scale bars: A–C = 0.1 mm.

Distribution. Cameroun (Gaud and Mouchet, 1957; Zumpt, 1961; Gaud, 1972), Russia (Vasyukova and Mironov, 1991), Korea (this study).

Deposition. NIBR No. NIBRIV0000754007–0000754008.

Molecular data. The *COI* sequence was obtained from single individual and deposited in GenBank with accession number of MK456598.

[1]*Subgenus *Conuralloptes* Gaud, 1972

[2]****Alloptes* (*Conuralloptes*) *limosae* Dubinin, 1951 (Figs. 3, 4)**

Alloptes gambettae limosae: Dubinin, 1951: 239, fig. 65.

Alloptes (*Conuralloptes*) *limosae*: Gaud, 1972: 66, figs. 26, 29; Vasyukova and Mironov, 1991: 98, fig. 72.

Material examined. 6♂♂, 3♀♀, Korea: Chungcheongnam-do, Asan-si, Tangjeong-myeon (36°48′58″N, 126°2′45″E), 18 May 2017, collected using dissecting microscope from flight feathers on the wings of black-tailed godwit *L. limosa* by Han Y.-D.

Description. Male (Fig. 3): Idiosoma 290–300 × 135–155 μm (length × width). Prodorsal shield (Fig. 3B): Posterior margin concave, length 74–82 μm along midline, width of posterior part 90–95 μm. Hysteronotal shield (Fig. 3B): Anterior part slightly concave, lateral margins with small incision at bases of setae *d2*, length 188–198 μm from anterior margin to bases of setae *ps1*, width 70–72 μm at anterior part. Distance 10–17 μm between prodorsal and hysteronotal shields along midline 10–17 μm. Distance between dorsal setae: *se* : *se* 98–105 μm, *c2* : *d2* 37–45 μm, *d2* : *ps1* 118–125 μm. Subhumeral setae *c3* lanceolate. Opisthosoma tapered to posterior end. Terminal lamella with 6 dentations, incision between inner pair slit-shaped. Setae *h2* cylindrical-shaped, without any expanded on basal half (Fig. 3A). Sternum (Fig. 3C): Epimerites I fused into a Y-shape. Pregneital sclerites (ps) connected to inner ends of epimerites IIIa and paragenital arch, divided from each other. Length of genital-anal field 97–105 μm. Setae *4b* situated on the same level of setae *3a*. Genital arch 19–20 × 17–21 μm (length × width). Setae *4a* surround by irregular sclerite. Distance between ventral setae: *4b* : *g* 37–44 μm, *4b* : *4a* 65–67 μm, *g* : *ps3* 24–26 μm, *ps3* : *ps1* 59–67 μm, *4a* : *4a* 90–97 μm. Setae *mG* of legs I and II spine-like with acute and blunted apex, respectively. Length of leg IV 153–155 μm.

Female (Fig. 4): Idiosoma 325–335 × 120–140 μm (length ×

Korean name: [1]*원뿔딴깃털진드기아속 (신칭), [2]*흑꼬리도요원뿔딴깃털진드기 (신칭)

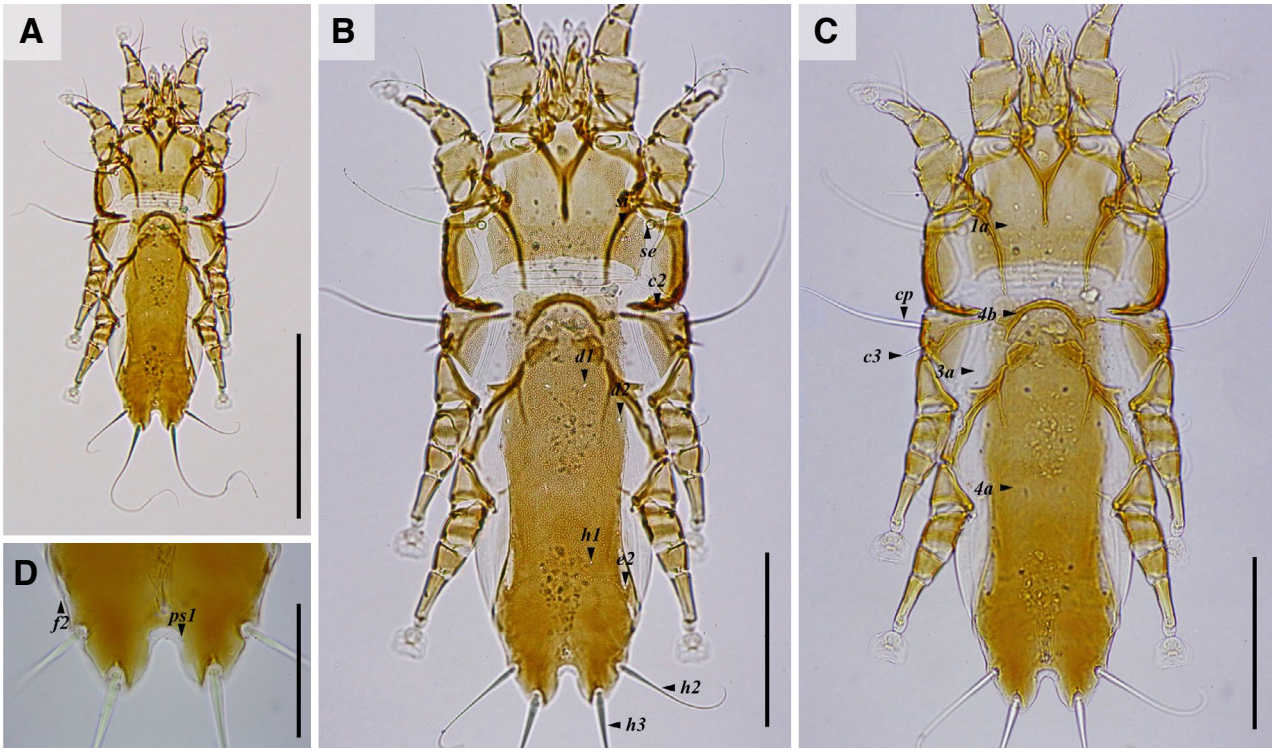

Fig. 4. *Alloptes* (*Conuralloptes*) *limosae*, female. A, Dorsal veiw; B, Dorsal idiosoma; C, Ventral idiosoma; D, Opisthosomal lobes. Scale bars: A=0.2 mm; B, C=0.1 mm; D=0.05 mm.

width). Prodorsal shield (Fig. 4B): Mostly shaped as in male, length 87–90 μm along midline, width 87–91 μm. Hysteronotal shield (Fig. 4B): Anterior margin straight, length 225–237 μm from anterior end to bases of setae *h3*, width 56–61 μm at anterior part. Distance 14–17 μm between prodorsal and hysteronotal shields. Setae *h1* located anterior to setae *e2*. Opisthosomal lobes well developed, terminal cleft as inverted U-shaped. Distance between dorsal setae: *c2*:*d2* 55–62 μm, *d2*:*e2* 92–101 μm, *e2*:*h2* 40–43 μm, *h2*:*h3* 14–17 μm, *h2*:*h2* 55–59 μm, *h3*:*h3* 32–37 μm. Supranal concavity oval, divided from terminal cleft. Sternum (Fig. 4C, D): Epimerites I fused. Epigynum bow-shaped, 23–27×40–43 μm (length×width). Leg I and II as in the male. Ambulacral disc IV extending to or slightly beyond the level of setae *h2*.

Remarks. *Alloptes* (*C.*) *limosae* was originally described by subspecies of *A. gambettae limosae* by Dubinin (1951) based on specimens collected from *L. limosa* in Russia. Thereafter, this species was redescribed by several mite taxonomists with detailed morphological description and illustrations (Gaud, 1972, Vasyukova and Mironov, 1991).

Alloptes (*C.*) *limosae* is highly similar to *A.* (*C.*) *procerus* Gaud, 1972 regarding external traits. However, *A.* (*C.*) *limosae* can be clearly distinguished from *A.* (*C.*) *procerus* by the following characteristics in males: (1) distance between prodorsal and hysteronotal shields is less than 20 μm; (2) setae *g* are located closer to setae *4b* than setae *ps3*; and (3) setae *h2* are cylindrical-shaped without enlargement in basal half (Gaud, 1972; Vasyukova and Mironov, 1991). The morphology of Korean specimens was consistent with the description and illustrations provided by Gaud (1972), and Vasyukova and Mironov (1991). However, unlike the description by Gaud (1972), the bases of setae *g* in all Korean males are closer to setae *ps3* than to setae *4b*. Although there is no description in Vasyukova and Mironov (1991), the bases of setae *g* in the illustration are closer to setae *ps3* than to setae *4b*. Therefore, we consider that setae *g* are closer to setae *ps3* than setae *4b*.

Host. This species was found on a flight feather in the wing of the black-tailed godwit *L. limosa*.

Distribution. Morocco (Gaud, 1972), Russia (Dubinin, 1951; Vasyukova and Mironov, 1991), Korea (this study).

Deposition. NIBR No. NIBRIV0000812910, NIBRIV 0000843152–0000843159.

Molecular data. The *COI* sequences were obtained from three individuals and deposited in GenBank with accession numbers of MK456599–456601.

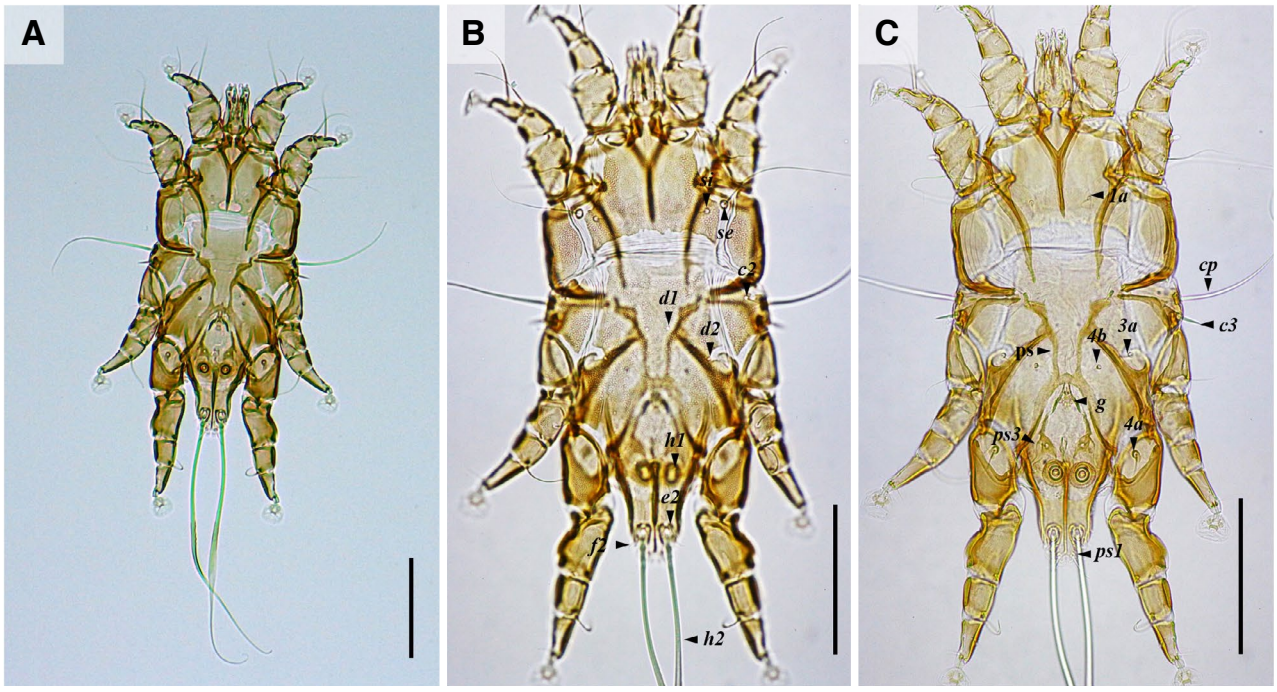

Fig. 5. *Alloptes* (*Conuralloptes*) *procerus*, male. A, Dorsal veiw; B, Dorsal idiosoma; C, Ventral idiosoma. ps, pregenital sclerites. Scale bars: A–C=0.1 mm.

[1]*3. *Alloptes* (*Conuralloptes*) *procerus* Gaud, 1972 (Figs. 5, 6)

Alloptes (*Conuralloptes*) *procerus*: Gaud, 1972: 64, figs. 26b, 27c, 29a; Vasyukova and Mironov, 1991: 98.

Material examined. 2♂♂, 3♀♀, Korea: Chungcheongnam-do, Taean-gun, Anmyeon-eup (36°36′4″N, 126°21′58″E), 1 May 2014, collected under a dissecting microscope from covert feathers on the wings of whimbrel, *N. phaeopus* by Han Y.-D.

Description. Male (Fig. 5): Idiosoma 305×140–150 μm (length×width). Prodorsal shield (Fig. 5B): Posterior margin concave, length 71–73 μm along midline, width of posterior part 90 μm. Hysteronotal shield (Fig. 5B): Anterior part slightly concave, lateral margins with small incision at bases of setae *d2*, setae *d2* on margin of these incisions, length 203–205 μm from anterior margin to bases of setae *ps1*, width 65–69 μm at anterior part. Distance 19–22 μm between prodorsal and hysteronotal shields. Subhumeral setae *c3* lanceolate. Opisthosoma gradually narrowed to posterior end. Terminal lamella with tree pairs of festoons, incision between inner pair slit-shaped. Setae *h2* cylindrical-shaped, slightly enlarged and flattened in middle part (Fig. 5A). Distance between dorsal setae: *se*:*se* 98 μm, *c2*:*d2* 37–39 μm, *d2*:*ps1* 125–35 μm. Sternum (Fig. 5C): Epimerites I fused into a Y-shape. Pregneital sclerites (ps) connected to inner ends of epimerites IIIa and paragenital arch, separated from each other. Length of genital-anal field 118–113 μm. Coxal setae *4b* located slightly posterior to *3a*. Genital arch 21×22 μm (length×width). Setae *4a* surrounded by irregular sclerite. Distance between ventral setae: *3a*:*4b* 5–9 μm, *4b*:*g* 18–23 μm, *4b*:*4a* 57 μm, *g*:*ps3* 28–32 μm, *ps3*:*ps1* 72–76 μm, *4a*:*4a* 91–95 μm. Setae *mG* of legs I and II spine-like with acute and blunted apex, respectively. Length of legs IV 155 μm.

Female (Fig. 6): Idiosoma 355–365×120–145 μm (length×width). Prodorsal shield (Fig. 6A): Mostly shaped as in male, length 68–71 μm along midline, width 84–86 μm. Hysteronotal shield (Fig. 6A): Anterior margin straight, length 240–248 μm from anterior end to bases of setae *h3*, width 54 μm at anterior part. Distance 20–27 μm between prodorsal and hysteronotal shields. Setae *h1* located anterior to setae *e2*. Opisthosomal lobes well developed, terminal cleft as inverted U-shaped. Distance between dorsal setae: *c2*:*d2* 64–66 μm, *d2*:*e2* 103–105 μm, *e2*:*h2* 42–46 μm, *h2*:*h3* 21–22 μm, *h2*:*h2* 64–66 μm, *h3*:*h3* 34–37 μm. Supranal concavity oval, incompletely separated from terminal cleft. Sternum (Fig. 6B): Epimerites I fused. Epigynum

Korean name: [1]*중부리도요원뿔딴깃털진드기 (신칭)

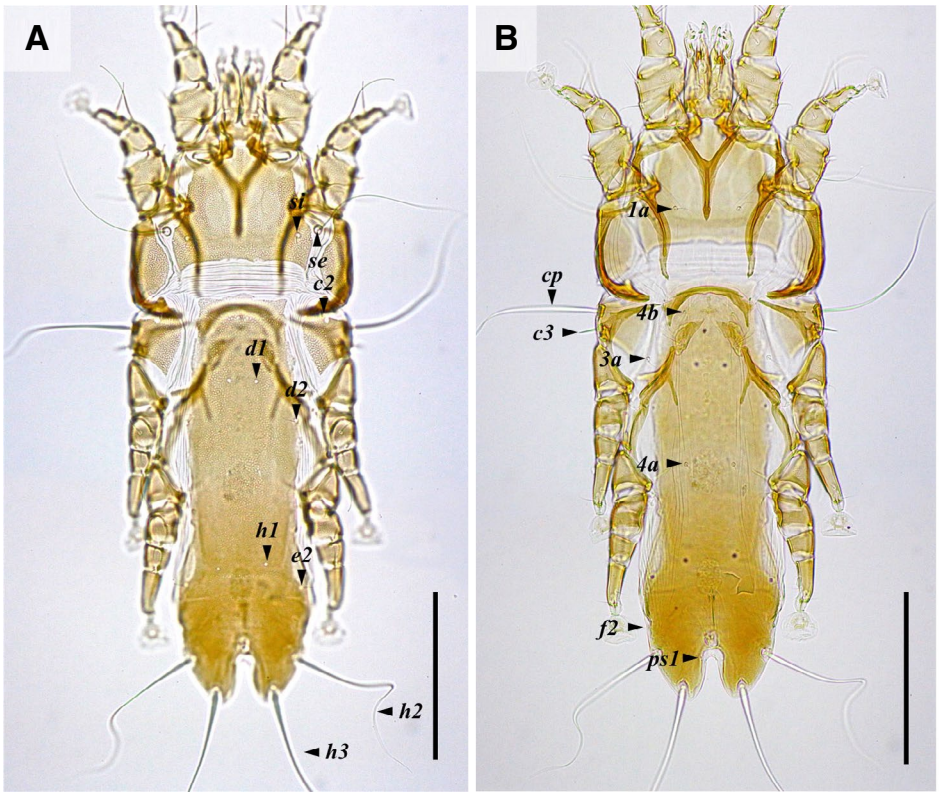

Fig. 6. *Alloptes* (*Conuralloptes*) *procerus*, female. A, Dorsal idisoma; B, Ventral idiosoma. Scale bars: A, B = 0.1 mm.

bow-shaped, 25–28 × 43–47 μm (length × width). Leg I and II as in the male. Ambulacra of legs IV not extending to the level of setae *h2*.

Remarks. *Alloptes* (*C.*) *procerus* was originally described by Gaud (1976) based on specimens collected from *N. phaeopus* in Cameroun and Mozambique. Thereafter, this species was recorded by Vasyukova and Mironov (1991) from *N. phaeopus* in Russia.

Alloptes (*C.*) *procerus* is very similar to *A.* (*C.*) *limosae* Dubinin, 1951 regarding external traits. However, *A.* (*C.*) *procerus* can be clearly distinguished from *A.* (*C.*) *limosae* by the following characteristics: (1) setae *g* are situated at middle of setae *4b* and *ps3* in males; (2) outer sclerites of termial lobe are almost straight in males; (3) distance between prodorsal and hysteronotal shields is more than 30 μm in females; and (4) supranal concavity is incompletely separated from terminal cleft in females (Gaud, 1972).

The Korean specimens were highly similar to Gaud (1972), although differences were found in the following characteristics: in males, setae *g* are closer to setae *4b* than setae *ps3*; and in females, distance between prodorsal and hysteronotal shields is 22–27 μm. We considered these difference to be an intraspecific variation.

Host. This species was found on a flight feather in the wing of the whimbrel, *N. phaeopus*.

Distribution. Cameroun, Mozambique (Gaud, 1972), Russia (Vasyukova and Mironov, 1991), Korea (this study).

Deposition. NIBR No. NIBRIV0000843147–0000843151.

Molecular characteristics. The *COI* sequences were obtained from three individuals and deposited in GenBank with accession numbers of MK456602–MK456604.

[1]*Subgenus *Sternalloptes* Kivganov and Mironov, 1992

[2]***Alloptes* (*Sternalloptes*) *fauri* Gaud, 1957 (Figs. 7, 8)**

Alloptes fauri: Gaud, 1957: 111, figs. 1D, 2C.

Alloptes (*Conuralloptes*) *fauri*: Gaud, 1976: 13, figs. 2b, 3b, 4b; Vasyukova and Mironov, 1991: 89, fig. 64.

Alloptes (*Sternalloptes*) *fauri*: Kivganov and Mironov, 1992: 199.

Material examined. 10♂♂, 9♀♀, Korea: Gyeongsangbuk-do, Ulleung-gun, Dokdo (37°14′20″N, 131°52′3″E), 16 Apr 2014, collected using dissecting microscope from flight

Korean name: [1]*갈매기딴깃털진드기아속 (신칭), [2]*갈매기딴깃털진드기 (신칭)

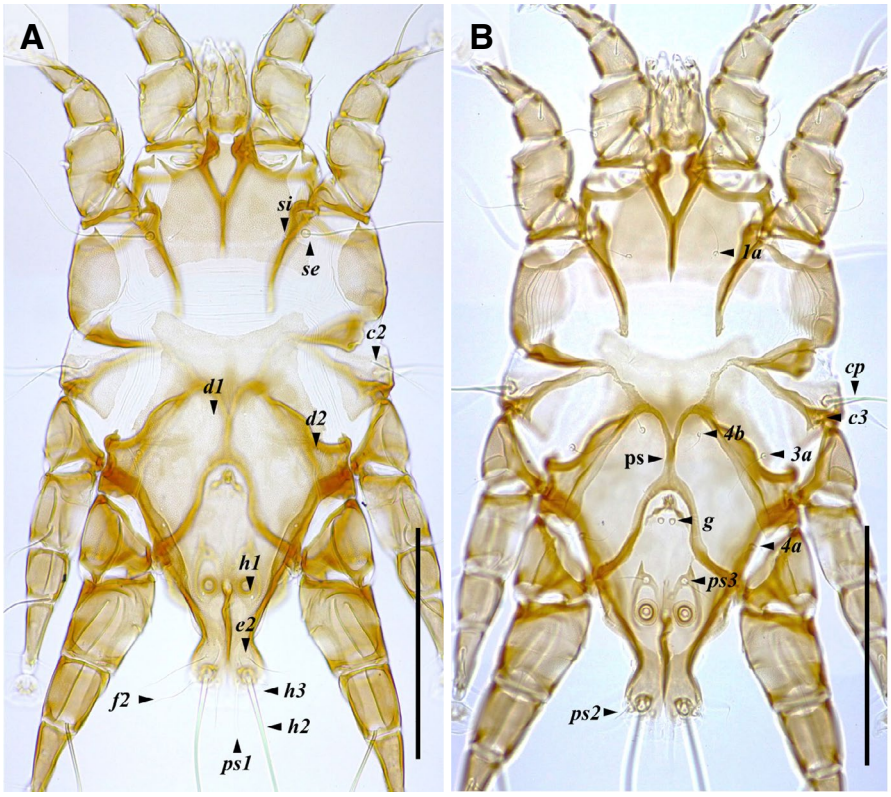

Fig. 7. *Alloptes* (*Sternalloptes*) *fauri*, male. A, Dorsal idisoma; B, Ventral idisoma. ps, pregenital sclerites. Scale bars: A, B = 0.1 mm.

feathers in the wing of the black-tailed gulls, *L. crassirostris* by Han Y.-D.

Description. Male (Fig. 7): Idiosoma 340–365 × 195–215 μm (length × width). Prodorsal shield (Fig. 7A): Posterior margin concave, length 73–78 μm along midline, width of posterior part 103–110. Hysteronotal shield (Fig. 7A): Anterior part slightly concave, lateral margins with small incision at bases of setae *d2*, length 230–238 μm from anterior margin to bases of setae *ps1*, width 95–115 μm at anterior part. Length 25–50 μm between prodorsal and hysteronotal shields. Subhumeral setae *c3* narrowly lanceolate. Opisthosoma gradually narrow and slightly expanded at the end. Terminal lamella with 6 dentations, incision between inner pair slot-shaped. Setae *h2* cylindrical-shaped, without enlargement in basal half. Distance between dorsal setae: *se* : *se* 93–10 μm, *c2* : *d2* 55–57 μm, *d2* : *ps1* 145–158 μm. Sternum (Fig. 7B): Epimerites I fused into a Y-shape. Pregenital sclerites (ps) Y-shaped, connected to inner ends of epimerites IIIa and paragenital arch. Genital arch 15–20 × 18–20 μm (length × width). Coxal setae *4b* located anterior to *3a*. Setae *4a* surrounded by irregular sclerite. Distance between ventral setae: *3a* : *4b* 11–20 μm, *4b* : *g* 48–55 μm, *4b* : *4a* 66–75 μm, *g* : *ps3* 32–38 μm, *g* : *h2* 118–129 μm, *ps3* : *ps1* 82–94 μm, *4a* : *4a* 100–110 μm. Setae *mG* of legs I and II spine-like with acute and blunted apex, respectively. Length of legs IV 195–213 μm, tarsus IV 49–53 μm in length. Solenidion *φ* of tibia IV about 1.6–2.0 times length of tarsus IV.

Female (Fig. 8): Idiosoma 350–395 × 150–175 μm (length × width). Prodorsal shield (Fig. 8A): Mostly shaped as in male, length 70–75 μm along midline, width 90–105 μm. Hysteronotal shield (Fig. 8A): Anterior margin straight, length 233–260 μm from anterior end to bases of setae *h3*, width 65–78 μm at anterior part. Setae *h1* located slightly anterior to setae *e2*. Supranal concavity oval, divided from terminal cleft. Opisthosomal lobes well developed, terminal cleft as inverted U-shaped. Anterior end of supranal concavity not extending to the level of setae *e2*. Length 50–53 μm between anterior end of supranal and posterior ends of opisthosomal lobes. Distance between dorsal setae: *se* : *se* 82–96 μm, *c2* : *d2* 60-69 μm, *d2* : *e2* 105–118 μm, *e2* : *h2* 32–40 μm, *h2* : *h3* 19–22 μm, *h2* : *h2* 53–59 μm, *h3* : *h3* 27–35 μm. Sternum (Fig. 8B): Epimerites I fused. Epigynum bow-shaped, 22–26 × 50–58 μm (length × width). Leg I and II as in the male. Ambulacral discs of legs IV reaching to the level of setae *h2*.

Remarks. *Alloptes* (*S.*) *fauri* was originally described by Gaud (1957) based on specimens collected from the lesser

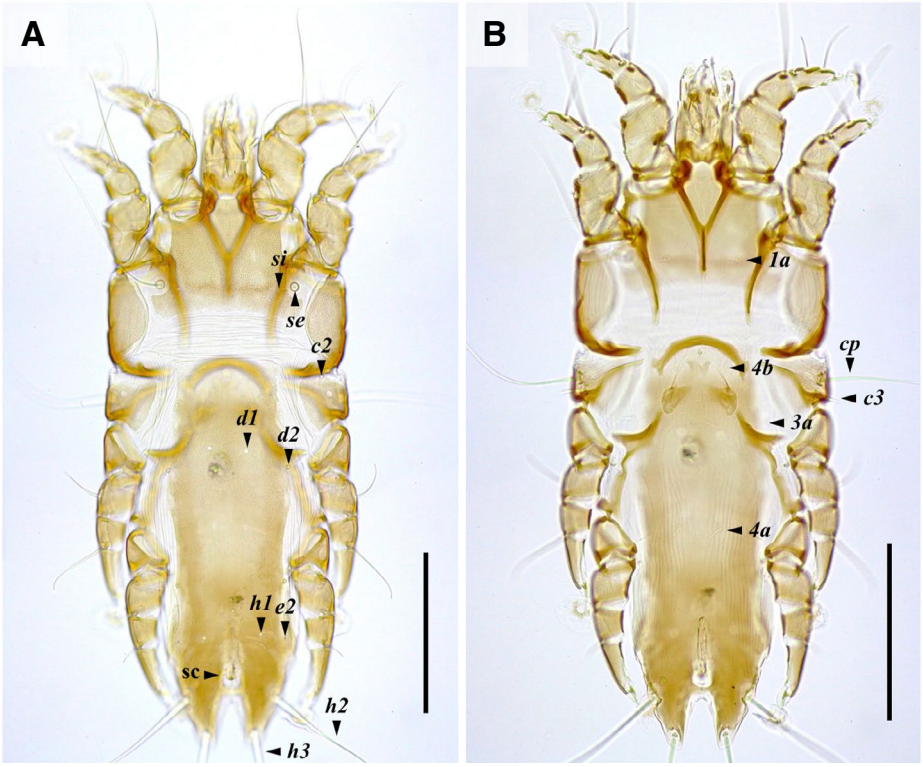

Fig. 8. *Alloptes* (*Sternalloptes*) *fauri*, female. A, Dorsal idiosoma; B, Ventral idisoma. Scale bars: A, B=0.1 mm.

black-backed gull *Larus fuscus* in Morocco. Thereafter, this species was redescribed by Vasyukova and Mironov (1991) with detailed morphological description and illustrations of ventral hysterosoma from *L. fuscus* in Russia.

Alloptes (*S.*) *fauri* is highly similar to *A.* (*S.*) *bisetatus* Haller, 1882 regarding external traits. However, *A.* (*S.*) *fauri* can be clearly distinguished from *Alloptes* (*S.*) *bisetatus* by the following combination characteristics: (1) distance between setae *g* and *h2* are 2.5−2.7 times longer than the that between setae *4b* and *g* in males; (2) setae *c3* are equal to or slightly longer than 30 μm in males; (3) anterior end of supranal concavity does not extend to the level of setae *e2* in females; (4) distance between anterior margin of supranal concavity and posterior end of opisthosomal lobe is less than 60 μm in females (Gaud, 1976). The morphology of Korean specimens was consistent with the original descriptions and illustrations of Gaud (1976).

Host. This species was found on flight feathers in the wing of the black-tailed gull, *L. crassirostris*.

Distribution. Morocco (Gaud, 1957), South Africa (Gaud, 1976), Russia (Dubinin, 1951; Vasyukova and Mironov, 1991), Korea (this study).

Deposition. NIBR No. NIBRIV0000812912, NIBRIV 0000843160−0000843177.

Molecular characteristics. The *COI* sequences were obtained from two individuals and deposited in GenBank with accession numbers of MK456605 and MK456606.

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